

The Chronology of Decomposition

Death

“The cessation of life; the ceasing to exist; defined by physicians as a total stoppage of circulation of the blood, and a cessation of animal and vital functions consequent thereupon, such as respiration, pulsation, etc.” **Black’s Law Dictionary**

Purpose

The purpose of this article is to provide the members of the Weber County Sheriff’s Underwater Recovery Team information central to the service the Team provides. This information is offered solely to increase the knowledge and understanding of complex details surrounding decomposition of bodies in underwater recoveries.

All information is offered as an educational tool to help prepare a diver for what may be encountered in underwater investigations of accidents, fatalities, or crime scenes. All forms (used by permission) attached to this article are offered and intended to benefit the Agency for whom the services of the Team are performed.

Decomposition

Due to the great number of variables which affect the onset and rate of decomposition, and the fact that any one variable could easily double or triple the speed of decomposition, the processes of decomposition (autolysis and putrefaction) do not afford the investigator with an accurate clock with which to assess the time of death or postmortem interval.

The following chronology of events involved in decomposition, however, could at least assist the investigator in determining to what degree the body “might be” decomposed.

Decomposition is a transition process which, when complete, returns the body to the elements from which it was originally created. It is a natural and methodical process, which can be reported on in a clear, concise manner.

The Chronology of Decomposition. The following sequence of events represents in considerable detail the process of decomposition. This timetable would normally be followed in water with a temperature range of 65F to 75F.

Twelve to Twenty-Four Hours- The skin is the first to change color, from normal to light blue to an almost green discoloration. This color change usually occurs in the, lower quadrant first, being most noticeable in the area of the lower abdomen / pelvis / groin.

Twenty-Four to Thirty-Six Hours. The discoloration becomes quite pronounced, and the skin takes on a marbled pattern. The blood is now reacting with hydrogen sulfide, which has been produced within the blood vessels. This produces a characteristic dark

green (almost black) discoloration. As putrefaction advances, the blood seeps from the blood vessels, giving the body a general purplish-black color.

Thirty-Six to Forty-Eight Hours: The face and trunk begin to swell noticeably, taking on the characteristic "bloated" appearance. The eyelids, lips, scrotum, and other sites where skin is loosely attached may become dramatically swollen and bloated. On palpation (feeling or manipulation) of these areas, crepitus (a feeling described as "rice crispies") is noticed.

Sixty to Seventy-Two Hours: Putrefaction has now spread to all areas of the body, including the fingers and toes. The entire body has now changed color, and facial features may become unrecognizable.

Four to Seven Days- Hair and nails become loose, and are easily removed unless the body is handled very carefully. The skin covering is easily damaged or torn loose. The body should still retain its structural integrity if carefully lifted by both arms and legs. Pockets of foul smelling gas usually form under the skin. These gas pockets may easily escape, allowing this putrid smelling gas to exit the body through any tears in the skin. As well as gases formed through putrefaction, malodorous, colored liquids may escape from the body from natural orifices, wounds, or skin ruptures caused by rough handling, injury or putrefaction. When putrefaction is advanced the skin of the hands (palmar) and feet (plantar) may become easily detached and make subsequent finger printing impossible. (This gas is what K-9's can hit upon)

Two Weeks and Beyond: In time, all soft tissues of the body (if not dried by heat) will be reduced to a gray, greasy, unrecognizable mass. Eventually, only skeletal remains are left behind to indicate the prior presence of a human body. In time, the skeleton will also be consumed.

The above chronology is given for reference. Individual situations CAN and DO vary due to the great number of variables which affect the onset and rate of decomposition.

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Anthropophagy

anthro·pophagy *n.*

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The eating human flesh; a cannibal. Latin anthrpophagus, from Greek anthrpophagos, *man-eating*: anthr po-, *anthropo-* + -phagos, *-phagous*.] **anthro·po·phagic** (-p-fjk) or **anthro·pophagous** (-pf-gs) *adj.* **anthro·pophagy** (-j) *n.*

In this regard, the concern is for the condition of the body and the effects of scavengers in the underwater environment that may feed upon the cadaver. Aside from the obvious fact that anthropophagy may render an otherwise "presentable" body disfigured, even beyond recognition, there is a second reason for a speedy body recovery whenever possible. Anthropophagy usually begins at sites of wounds, and quickly alters the appearance of any wound, which was inflicted upon the victim. The

speed at which a body should be recovered is somewhat dependent on what is known about the populations of scavengers in the search area. A speedy body recovery will not only result in a more efficient, accurate autopsy, but also hopefully make victim identification less traumatic for family and friends.

Putrification

putrification \Pu`tri*fi*ca"tion), n. Putrefaction.

Putrification is the major component of the process commonly called decomposition. It is a bacterial action, which proceeds at an accelerated rate postmortem, when the natural defenses of the living body cease to hold bacteria in check.

The bacteria present after death multiply rapidly and when in sufficient quantity possess the capability to literally digest the soft tissues of the body, reducing them to a fluid consistency. A byproduct of this process is a complex mixture of foul smelling gases.

When gas production occurs within the body's blood vessels, as well as soft tissues (e.g.: muscle tissue, organs, etc.), the body becomes distended and appears swollen. Skin color changes through blue, green, purple, brown, and eventually to black. The eyes and tongue may be forced to protrude well out from their supporting structures. Because of increased pressure in the viscera (abdomen), there may even be gross protrusion of the abdominal organs through the vaginal and rectal openings.

The skin, in an advanced state of putrefaction, softens and becomes easily detached from its supporting structures. If roughly handled, large areas of skin may easily be removed from the body, even though the arms and legs are still firmly attached to the trunk.

The skin may be evenly discolored, or it may exhibit a patchwork of colors, depending on the varieties of bacteria present and the degree of putrification.

Since most pigment is contained within the skin, as this layer of skin becomes dislodged through rough handling, the underlying pink musculature of the arms or legs may be revealed.

Skin slippage is present in all cases of advanced putrefaction. Where the identity of the body has not been determined, the victim's body should be treated very carefully!

Fingerprint examination is often used for positive identification, and when putrefaction is well established, the entire epidermis (skin layer) of the hands may become detached in a glove-like configuration. Areas of skin still retaining a usable fingerprint may become detached and lost unless the body is treated with great care.

Factors that effect putrification include Temperature, Obesity, and Environment. Bodies in advanced stages of putrification must be handled and bagged with care.

Autolysis

autolysis *n.*

The destruction of tissues or cells of an organism by the action of substances, such as enzymes, that is produced within the organism. Also called self-digestion. **auto-lytic** *adj.*

In a human body, autolysis occurs after death when digestive enzymes continue to work within the body without the normal controls present during life. Normally, these digestive enzymes begin their work in the stomach where hydrochloric acid is introduced. Adequate secretion of mucus by the stomach lining protects the stomach from damage by this powerful acid. As the hydrochloric acid and other enzymes break down food, it is passed on to the small intestine where further enzymes are introduced. During the normal process of digestion, these acids and enzymes react to break down complex carbohydrate and protein molecules to simpler molecules, which can be absorbed into the bloodstream and provide nourishment and energy to the living body.

During life, our gastrointestinal (digestive) tract actively produces mucus, which protects the living tissue from destruction. After death, in the absence of this defense, these acids and enzymes will continue to react, and eventually they will break down the tissues of the gastrointestinal tract. When this occurs, perforation of the stomach, lower esophagus and intestine will occur. Once these digestive enzymes seep into the abdomen or pleural (lung) cavity, their reaction with the internal organs of the body may continue unabated. Simply described, the body begins to digest itself.

Often, seepage of these enzymes into the pleural cavity may occur within hours. When these enzymes react with the lungs, the lung tissue is destroyed quickly. This action explains why a drowning victim may be recovered within twenty-four hours, displaying virtually no evidence of decomposition, yet when removed from the water, a bubbly, malodorous, sanguineous (blood-stained) fluid is seen exuding from the mouth and nostrils. In cases where autolysis is more advanced, this fluid will take on a more watery consistency with a light brown-green color. Its odor is quite characteristic and intense.

This "dissolving" or autolysis of the lungs is called *pulmonary autolysis*. It is often hastened by stomach contents (gastric juices & acids) which are breathed into the lungs during the convulsive vomiting and agonal gasp phases of drowning. Because of the digestive juices that may be drawn into the lungs during the agonal gasp phase, pulmonary autolysis may be more advanced in the lungs than elsewhere in the body. In addition to this, stomach contents containing gastric juices may accelerate this process in specific areas of the lungs, so that pulmonary autolysis is seen, during the autopsy, to proceed at an uneven rate. Though not conclusive proof, this observation is indicative of death due to drowning.

In summary, Autolysis is a 'dissolving' of the tissues in the pleural (lung) cavity and abdomen due to the seepage of digestive juices. The onset of autolysis usually precedes putrefaction. Pulmonary autolysis is primarily responsible for the malodorous, brownish-green, blood-stained fluid often seen seeping from the nose and mouth of a

drowning victim whose body is recovered before putrefaction has begun. Autolysis is not putrefication.

Primary and Secondary Flotation

Origin and Nature of 'Refloat' Gases: Gases which are produced within a putrefying cadaver are primarily (though not exclusively) carbon dioxide, hydrogen sulfide, ammonia, methane, and sulfur dioxide. These gases are formed in varying quantities and percentages. Rarely will any two putrefying cadavers produce the same gases in the same quantities.

These gases, which are formed as a result of bacterial action, are produced at various sites within the body. As these gases form, buoyancy is created and the body, in many cases, eventually resurfaces in what is commonly referred to as the reflation phenomenon. When and how the victim will resurface depends on many factors, including the site of the gas production within the body. Since gas is produced in (chiefly) two different locations, each will be discussed separately.

Primary flotation is usually a result of gases produced within the digestive tract. A distended abdomen is characteristic of "primary flotation". Putrefactive gases formed during the primary flotation phase may be released through the mouth, nose and anus during the handling and removal of the body. It is common to see an individual 're-floated' between 24 to 72 hours in water of 68F. During "primary flotation" the body will usually float, face down presenting a very low profile above the water. It is not uncommon for bodies to release some gas at the surface, lose buoyancy and sink again to the bottom. Depending on depth, the body will remain until secondary reflation.

Secondary flotation involves gas production in other areas of the body or of the bodies' tissues. A general swelling of the limbs, trunk, face, etc characterizes secondary flotation. In this stage, gases form equally throughout the body. A victim who is exhibiting 'secondary flotation' is very buoyant. During secondary flotation the body may float face-up or face-down due to their buoyancy being evenly distributed in the abdomen and the limbs. Bodies such as this usually represent a very stable buoyancy.

Factors affecting the "time to refloat": Due to the many variables involved no reliable charts or tables exist to provide a reliable formula for predicting time to reflation. The following are factors that will provide insight in the speed or delay in "refloat".

Stomach contents or last meal including the quantity consumed and the time elapsed from consumption will have an effect on refloat time. Some foods restrain the formation of gas while others such as carbohydrate rich foods build gas quickly. Time is the primary component with regard to location of food within the digestive tract. Food that is in the stomach location may be less apt to produce gas compared to food, which has

passed into the small intestine. Gases formed in the stomach are released more quickly than gases further along the digestive tract.

Water Temperature affects gas production by regulating bacteria growth. It is bacterial action within the cadaver that generates the gas. The warmer the water, the greater the bacterial action or growth and shorter the potential interval to refloat.

Depth is a factor in that the volume of gas formed is considerably reduced. Most gas is formed as a result of the putrefication process. These gases are highly soluble and easily compressed. Given the effect of pressure at depth and the high solubility of the gas, bodies at depths greater than 100 feet may not have sufficient buoyancy to refloat at all.

Lean / Fat ratio or Body Mass Index is another factor in estimating time to refloat. Individuals who are higher in body fat percentage typically will refloat quicker than individual with a low body fat percentage. The reasons for the quicker refloat intervals are linked to the higher buoyancy of fat and the tendency for fat to putrefy at a faster rate than leaner bodies. It is hypothesized that bodies with higher fat percentages retain heat longer, accelerating putrefication.

Antemortim Health in that all living bodies contain microorganisms, which will ultimately, produces gas-affecting reflation. It is the quantity and array of bacteria in the body will have an effect on the type and amount of gas produced. As a rule, the healthier an individual is, the greater the interval to refloat.

In conclusion

I hope you have profited from the preceding information. I realize it was long and rather graphic. The idea however is to provide factual information to assist in recoveries that involve trauma or bodies that may be underwater for extended lengths of time.

In spite of the research and information available, it is not likely that an accurate scale will ever be developed which will enable the diver to determine time to refloat. The variables are many, and each one has the capability of drastically affecting the outcome.

Our primary responsibility is to perform our activities safely and efficiently. Our task is no longer a simple "body recovery", but rather to be the eyes and hands of Agency investigators in the aquatic environment. Today, the investigator needs to know (through us) by observing certain signs and evidence, what happened, when it happened, and why it happened. The information that we put together can and will be invaluable to an investigation or a legal proceeding.

More to come, stay tuned....

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